



Idaho National Engineering and Environmental Laboratory

Recent US Data Work and Plans for DIII-D Data Analysis

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Recent US data work

- **Recent data harvest activity on electrical distribution components**
 - **Component failure rates for transformers, circuit breakers, switchgear, cables, etc.**
 - **Component repair times**
 - **Initiating event frequencies**
 - **Fair comparison to an independent data set**
- **These data support in-plant fire hazards analysis, and probabilistic safety assessment**

Electrical component data sample

- **Metal enclosed bus, failure, average failure rate of $1.0\text{E-}07/\text{h}$, upper bound of $5.0\text{E-}07/\text{h}$**
- **Cable failure, average failure rate of $3\text{E-}09/\text{h-foot}$, upper bound of $9\text{E-}09/\text{h-foot}$**
- **Circuit breaker, up to the kV range, fails to open/close, average failure rate of $3.7\text{E-}04/\text{d}$, upper bound of $9.3\text{E-}04/\text{d}$**
- **Power transformer failure, average failure rate of $1\text{E-}06/\text{h}$, upper bound $1\text{E-}05/\text{h}$**
- **Published in report INEEL/EXT-01-01558, 11/01**

Recent US data support

- **Charles Gordon informally requested in-plant fire data last fall**
- **Edgar Ebert informally requested data support on in-vessel components last fall**
- **Limited reliability and risk support to the IFE design community from LLNL**
- **Some limited, informal support to the US ARIES and APEX/ALPS design studies**
- **Safety support to Current Drive Experiment-Upgrade (CDX-U) for their liquid lithium tray limiter**

US data work, near-future tasks

- **Possibly some work for the Fusion Ignition Research Experiment (FIRE) at PPPL**
 - **May perform coarse quantification of functional event trees for a Safety Assessment in support of an Environmental Assessment**
- **Possibly some limited-scope work to support the National Compact Stellarator Experiment (NCSX) at PPPL**
 - **Construction funding approval is pending for this \$70M, small fusion device (plasma radius = 1.4 m)**

Near-future plans for data work

- **Data harvest on remote handling equipment**
 - **These data support accident analysis of shutdown conditions, plant availability estimates**
 - **More data is becoming available on robotics and remote handling (from waste cleanup, automated manufacturing, etc.)**
- **Possible continuation of work on liquid wall reliability estimates**

Liquid walls are receiving increased attention in the US

- **CDX-U at PPPL is using liquid lithium in a static tray limiter (preliminary results were reported at the 19th SOFE)**
- **SNL will test a flowing lithium jet under e-beam high heat fluxes in their Liquid Metal Integration Test System (LIMITS) apparatus late this year**
- **US plans are for completing a design for a liquid lithium wall for the National Spherical Torus Experiment (NSTX) by late 2004; deployment decision in 2005**
- **There may be some data support work for these activities**

Data analysis to support liquid walls

- **Peter Petersen of DIII-D has given permission to review their trouble reports and operations data for the vacuum vessel and vacuum system**
- **These data are important for estimating the confinement reliability of a liquid wall reactor, as well as other vacuum systems**
- **The DIII-D data results will be compared to John Orchard's published vacuum data on JET**
- **This work should be completed before the end of the calendar year**

Data analysis to support liquid walls (con't)

- **An update of vacuum component reliability estimates will support other safety activities as well**
 - **Tokamak LOVA frequency supports risk estimation of oxidation-driven volatilization, and in-vessel dust mobilization scenarios**
- **The results will be shared with Task 5 participants**

Longer-term data directions

- **Further cooperation with the Japan TPL, comparing their data analysis results to past TSTA data values would be beneficial for tritium plant safety assessment**
- **The vacuum work also serves to update past data harvesting for vacuum components from 1994**
- **Other harvesting results should be revisited, including the cryogenics and magnet data from the early 1990's**
- **In Idaho, there is some interest in laboratory equipment reliability due to new experiment campaigns with hazardous materials**